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A CASE STUDY FOR A TIDAL INTERACTION BETWEEN DWARF GALAXIES IN UGC 6741

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ABSTRACT

We present a case study of the tidal interaction between low mass, star-forming, galaxies initially found exploring the Sloan Digital Sky Survey (SDSS) images and further analyzed with SDSS spectroscopy and UV GALEX photometry. With a luminosity of $M_r = -17.7$ mag and exhibiting a prominent tidal filament, UGC 6741 appears as a scale down version of massive gas–rich interacting systems and mergers.The stellar disk of the smaller companion, UGC 6741_B, which is three times less massive, has likely been already destroyed. Both galaxies, which are connected by a 15 kpc long stellar bridge, have a similar oxygen abundance of 12+log(O/H)$\sim$8.3. Several knots of star-forming regions are identified along the bridge, some with masses exceeding $\sim 10^7$ M$\odot$. The most compact of them, which are unresolved, may evolve into globular clusters or Ultra Compact Dwarf galaxies (UCDs). This would be the first time progenitors of such objects are detected in mergers involving dwarf galaxies. UGC 6741 has currently the color and star formation properties of Blue Compact Dwarf galaxies (BCDs). However the analysis of its surface photometry suggests that the galaxy lies within the scaling relations defined by early-type dwarf galaxies (dEs). Thus UGC 6741 appears as a promising system to study the possible transformation of BCDs into dEs, through possibly a merger episode. The frequency of such dwarf-dwarf mergers should now be explored.

Subject headings: galaxies: dwarf, galaxies: evolution galaxies: formation - galaxies: stellar population

1. INTRODUCTION

Since Halton Arp published an atlas of peculiar galaxies and Toomre & Toomre (1972) reproduced their shape with numerical simulations of tidal encounters, mergers have become key processes in the understanding of galaxy evolution. Simulations show how colliding disk galaxies are reshaped into pressure-supported early-type bodies after the final merger. In a ΛCDM cosmology (Spergel et al. 2007), which assumes that the assembly of large scale structure happens in a hierarchical fashion, mergers play a fundamental role in the growth and evolution of galaxies (Conselice et al. 2009).

During the intermediate phases of interactions, large scale tidal interactions trigger the formation of peculiar features like shells, streams, bridges and tails. The presence of such structures which is predicted by numerical simulations is now frequently observed in deep imaging surveys (Duc et al. 2011, 2015; Kim et al. 2012; Struck 1999; van Dokkum 2005).

Numerous works have detailed the various phenomena occurring during galaxy interactions, including the formation in the collisional debris of substructures, like Tidal Dwarf galaxies (TDGs) (Duc et al. 2007). However the vast majority of such studies focused on massive galaxies. Not much is known on tidal forces generated by the encounter between low mass galaxies.

It is common belief that, having a shallow potential well, low mass galaxies have an evolution which is more driven by the large-scale environment than by merging events. Dwarf galaxies exhibit a strong morphological segregation: the most evolved / oldest dwarf galaxies, i.e dwarf Spheroidal (dSph) or dwarf early-type (dE), are found in the group and cluster environments (Kormendy et al. 2009; Lisker 2009), while dwarfs with on-going star-formation activity, such as Blue Compact Dwarf galaxies (BCDs, Gil de Paz et al. 2003; Papaderos et al. 1996) are mainly found in less dense environments. However, how precisely the environment contributes to the transformation of star-forming dwarfs to anemic dEs is still a puzzle as several processes may play a role (Boselli & Gavazzi 2006). Besides, the mechanism that triggers the burst of star-formation in dwarf galaxies, particularly in BCDs, also remains a mystery. Mergers, fly-by encounters or gas turbulence have been proposed (Bekki 2008; Noeske et al. 2001; Pustilnik et al. 2001).

Very recently, observational evidence for mergers between dwarf galaxies has been growing (e.g. Amorisco et al. 2014; Crnojević et al. 2014; Toloba et al. 2014; Martínez-Delgado et al. 2012; Johnson 2013; Nidever et al. 2013; Graham et al. 2012; Penny et al. 2012; Rich et al. 2012; Geha et al. 2005). The possibility that dEs might be formed through mergers like the massive ellipticals has been proposed. If this is the case, one would expect the progenitors of dEs to exhibit the characteristics features of mergers such as tidal tails.

The system presented here, UGC 6741, was initially disclosed in a systematic eye inspection of tidal debris in the Sloan Digital Sky Survey (SDSS) images. It turned out to be classified as a low surface brightness galaxy pair in Schombert & Bothun (1988). We report a multiwavelength study of the system based on archival optical images and spectra from the SDSS DR7 release and UV-images from the Galaxy Evolutionary Explorer (GALEX) all sky survey (Abazajian et al. 2009; Martin et al. 2005).

2. DATA AND ANALYSIS

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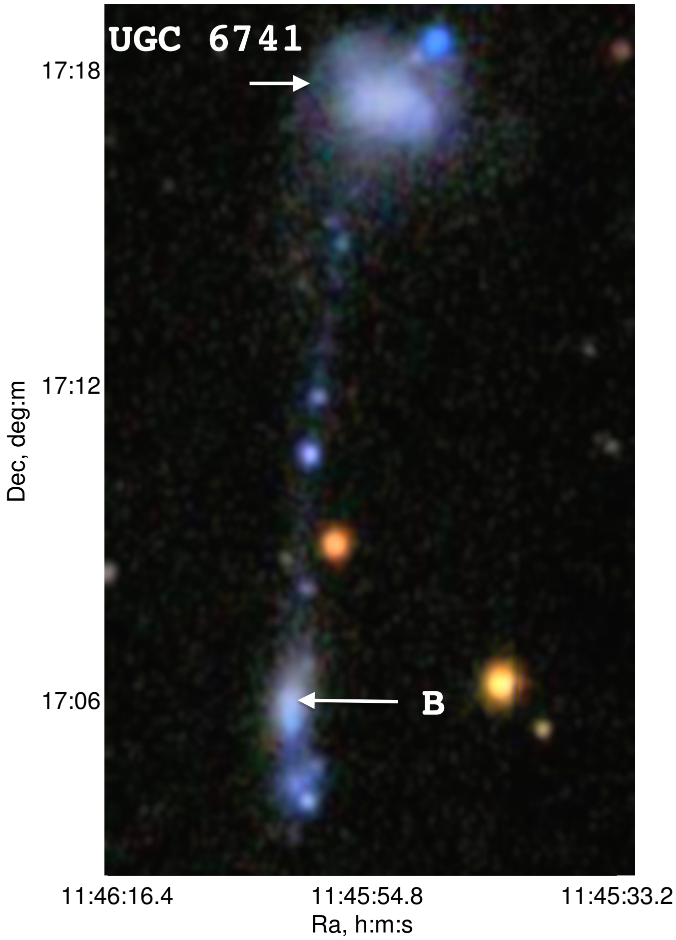

FIG. 1.— True color $g+r+i$ SDSS image of UGC 6741. Compact blue star-forming regions are distinctly visible in the tidal bridge between UGC 6741 and its companion disrupted galaxy, UGC 6741_B. The 65" × 100" cutout image was queried from the SDSS DR7 sky server.

2.1. *Target selection and location*

In an our effort to search for tidal features around low mass nearby galaxies, we visually inspected true color $(g+r+i)$ SDSS images of nearly 40 000 galaxies located at redshift below 0.02. The most prominent tidal feature was found in the galaxy pair, UGC 6741. With a luminosity $M_r = -17.7$ mag, UGC 6741 is slightly fainter than the two well known local group dwarf galaxies, the Large Magellanic Cloud (LMC) and NGC 4449 [2]. Its interacting companion, here after UGC 6741_B, has a luminosity of $M_r = -16.2$ mag [3].

By chance, UGC 6741 benefits from substantial multi-wavelength data in public archives, which allowed us to perform a thorough analysis of its morphology, chemical properties and stellar populations.

As shown in Figure 1 and Figure 3, a 15 kpc long stellar bridge connects the two galaxies along the North-South direction. It hosts a number of compact blue clumps – the most prominent ones are named objects A, C, D, E and F. Object F is located to the North of UGC 6741, and either belongs to a secondary tail or to the bridge if the latter wraps around in the proximity of the galaxy. Overall the system resembles classic mergers of massive gas-rich disk galaxies.

[2] Incidentally these two latter galaxies are also involved in a tidal interaction.

[3] Throughout the paper, we assumed a distance to the galaxy of D = 54.2 Mpc, which is the distance of the main galaxy group member, NGC 3853 provided by NED.

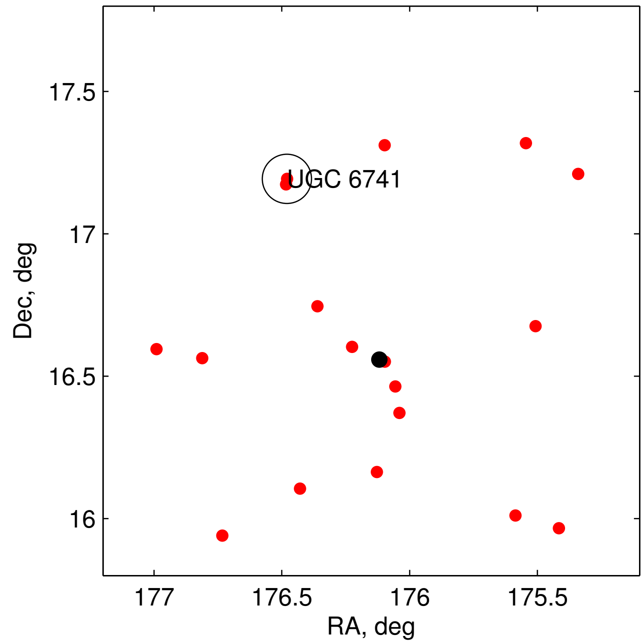

FIG. 2.— Position of UGC 6741 (en-circled) in the NGC 3853 group. The central galaxy, NGC 3853, is shown with a black dot and the other group members with red dots.

UGC 6741 is located on the outskirts of a group with an angular distance of 0.73 degree from the central galaxy, NGC 3853. In Figure 2, we show the group member galaxies located around a radius 700 kpc centered on NGC 3853 and with relative radial velocities within ±500 km/s. We used the NED database to carry out this search. The difference in radial velocity between NGC 3853 and UGC 6741 is less than 100 km s^{-1}.

2.2. *Imaging and Photometry*

To perform a detailed image analysis, we retrieved archival images from the SDSS-DR7 database (Abazajian et al. 2009). We used the r-band image as a reference, since it provides a higher signal to noise ratio on the tidal debris than the other bands. The seeing in this field is 0.9" (as measured from the r-band PSF). In order to enhance the detectability of the bridge and the faint objects within it, a $g+r+i$ co-added image was made (see Fig. 3, left), and a galaxy model subtraction has been carried out (see Fig. 3, middle). On such images, object B appears to be much more luminous, extended and redder (see Fig. 3, right) than the clumps A, C, D, E and F located along the tidal feature. As previously mentioned, B is most likely the main body of the disrupted companion of UGC 6741. The bluest clump, object E, is located at the upper tip of the bridge and embedded within the stellar halo of UGC 6741. Object A is somewhat irregular and contains several compact sub-clumps.

The total luminosity of the clumps was determined from aperture photometry. The sky value has been estimated in 5 independent regions of 10×10 pixel randomly chosen around UGC 6741. Their mean value was com-

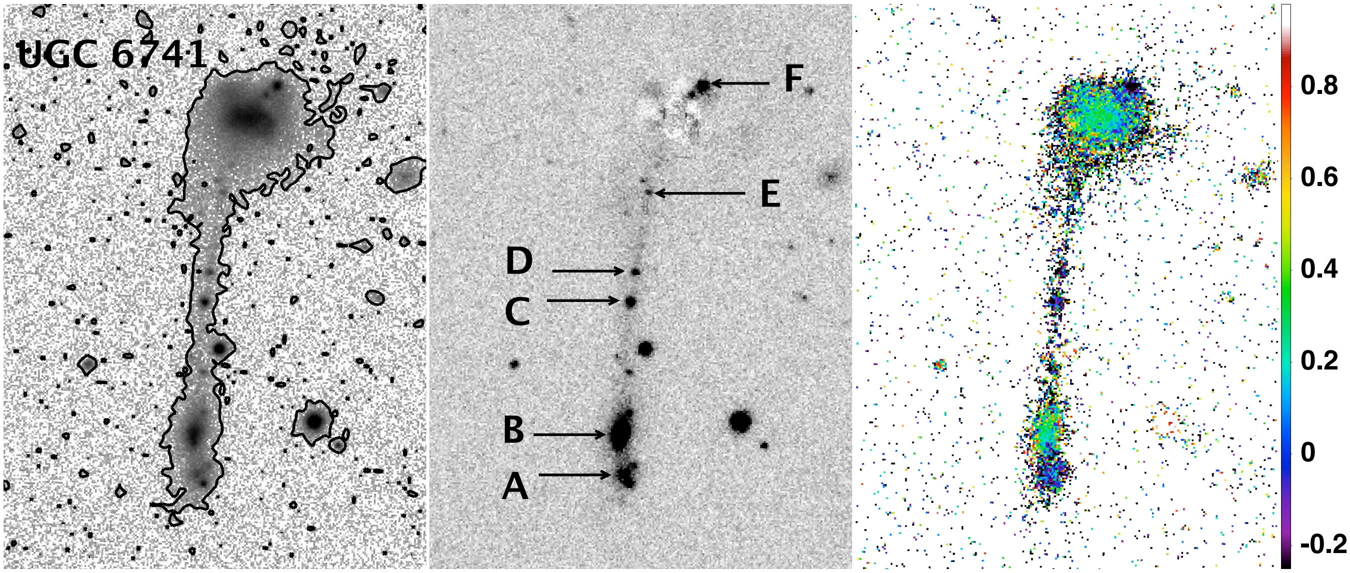

FIG. 3.— The interacting system, UGC 6741, as seen in the optical with the SDSS. *Left:* co-added $g+r+i$ image with an arcsinh scaling. The black contours represent the detection limit of 3σ corresponding to a surface brightness level of $\sim$25.5 mag-arcsec^{-2} in the r-band. *Middle:* Residual image after having subtracted a model galaxy of UGC 6741. Prominent star-forming clumps are named in alphabetical order starting from the bottom. Note that object B is likely the main body of the low-mass companion of UGC 6741 and is referred as UGC 6741_B in the main text. *Right:* $g-r$ color map, with the scale in mag indicated to the right. The field of view of each image is 90" × 120".

puted and subtracted from the measured fluxes. We list the positions, absolute magnitudes and stellar masses of the clumps in Table 2. The derived magnitudes were corrected for the Galactic extinction using Schlafly & Finkbeiner (2011), but not for the internal extinction. We find that all of them have $g-r$ color index less than 0.25 mag and the bluest, F, has a $g-r$ color index as low as -0.03 mag. Their blue color and detection in the UV by GALEX (see Fig 4) is totally consistent with the hypothesis that they are star-forming regions. The stellar masses were derived from the SDSS$-r$ band magnitude with a mass to light ratio tabulated by Bell et al. (2003) and appropriate to the observed $g-r$ color. These values are most likely upper limits.

The extended Clump A, located at the tip of the tidal feature, is the brightest star-forming region. The fairly compact regions C, D and and E are actually likely wrongly classified as stars in the SDSS catalog. Our measured FWHM for these knots are well consistent with the median FWHM of foreground stars, i.e. 0.9" and in the absence of available radial velocities, we cannot totally exclude chance superposition of foreground blue stars or background compact objects. However, the remarkable alignment of these objects along the stream and their similarity in color (see Figure 1 & 3) are strong hints for a real physical association with the system.

The interacting dwarf galaxies and associated tidal debris are clearly detected in the NUV, and barely detected in the FUV by the GALEX all sky survey (see Fig. 4). Since the GALEX images have a spatial resolution of only 5", the star-forming regions are not resolved individually in the UV images. The star formation rates, derived from the FUV fluxes applying a Galactic extinction correction from Schlegel et al. (1998), and using the calibration of Kennicutt (1998), are given in Table 1.

With the help of the IRAF *ellipse* task, we performed a surface photometry analysis of UGC 6741. First, we

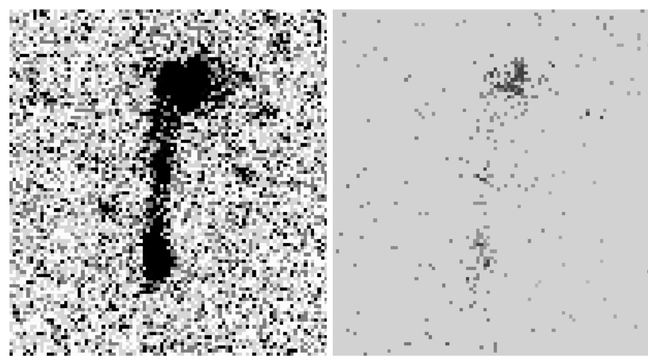

FIG. 4.— GALEX all sky survey NUV (left) and FUV (right) images of UGC 6741.

extracted the galaxy major-axis light profile from the $r-$band image. In doing so, the centre and position angle of the ellipse were held fixed and the ellipticity was allowed to vary. The centre of the galaxy was calculated using the task *imcntr* and input ellipse parameters were determined using the several iterative runs of the *ellipse* task. The derived $r-$band major axis light profile of UGC 6741 is shown in Figure 5. With the help of χ^2-minimization scheme, we obtained a best fit model where the observed profile is decomposed into the two component Sérsic functions. The inner and outer components are best fitted with the Sérsic functions of n = 0.61 and 3, respectively.

Since the observed light profile of UGC 6741 is better represented by a multi component Sérsic function the derivation of the effective radius and effective surface brightness is not obvious. Therefore, we estimated these parameters with a non-parametric approach. Using the similar procedure followed by Janz & Lisker (2008), we first calculated the Petrosian radius and the total flux was measured within two Petrosian radius. Note, that contrary to Janz & Lisker (2008), we do not correct

TABLE 1
Global properties of the system

Galaxy	Ra	Dec	Mr	v_r	M_*	SFR(m_{FUV})	12 + log(O/H)	R_e	$< \mu >_r$
	^{o}	^{o}	mag	km s^{-1}	$M_\odot$	$M_\odot$ yr^{-1}	dex	kpc	mag $arcsec^{-2}$
UGC 6741	176.4793	17.1923	-17.74 ± 0.01	3390	6.0×10^8	0.09(17.96±0.08)	8.3	1.2	21.71
UGC 6741_B	176.4827	17.1732	-16.16 ± 0.01	3300	1.9×10^8	0.03 (19.01±0.12)*	8.3	–	–

The SFR is estimated from the FUV magnitude given in the parentheses. A galactic extinction correction has been applied using the formula A_{FUV} = 8 × E(B-V) with E(B-V) = 0.2. The stellar mass is derived from the $r-$band luminosity and the mass to light ration obtained from Bell et al. (2003) for the color $g - r$. The value of the Oxygen abundance, 12 + log(O/H), is derived with the O3N2 method which has a typical systematic error of 0.2 dex.
* The FUV flux and derived SFR includes the star forming region A, see Fig 3.

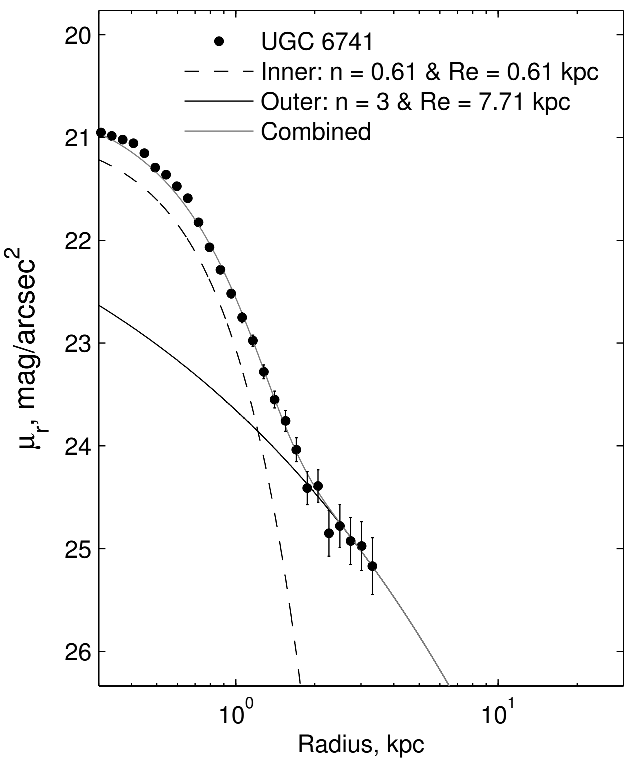

Fig. 5.— Major axis radial profile of UGC 6741, where the observed profile is fitted with two component Sérsic model.

for the the missing flux estimated by Graham & Driver (2005). Indeed this correction is very small for dwarf galaxies (Chen et al. 2010). The derived values of the structural parameters of UGC 6741 are given in Table 1. We find that the mean surface brightness within the half-light radius is 21.7 mag $arcsec^{-2}$ in the SDSS $r-$band. This is in fact a rather low value of the surface brightness of a low-surface brightness galaxy, as described in Schombert & Bothun (1988).

Besides, we performed the aperture photometry on the entire system. For this, we first manually masked all non-related objects and selected a large aperture that includes the entire system. The total $r-$band luminosity is m_r = 15.53 ±0.01 and $g - r$ color index is 0.1 ±0.01 mag. The FUV and NUV luminosities are 17.21 ±07 and 17.06 ±03 mag, respectively. Using the same conversion factors as for the individual sub-structures, we derived a total stellar mass $M_{*,total}$ = 8.3×10^8 M⊙ and a total star-formation rate SFR_{total} = 0.18 M⊙ yr^{-1}.

2.3. *Gas content*

TABLE 2
Photometry of the star forming tidal clumps

	Ra	Dec	g	r	i	M_*
	^{o}	^{o}	mag	mag	mag	10^8M⊙
A	176.4821	17.1704	18.46±0.02	18.52±0.03	18.39±0.04	0.35
B	176.4827	17.1732	17.76±0.02	17.51±0.02	17.37±0.02	1.94
C	176.4820	17.1810	19.42±0.03	19.55±0.04	19.33±0.05	0.11
D	176.4817	17.1827	20.51±0.05	20.73±0.08	20.44±0.10	0.03
E	176.4808	17.1875	20.83±0.06	21.07±0.10	20.59±0.10	0.02
F	176.4775	17.1940	18.05±0.01	18.08±0.02	18.23±0.03	0.57
U	176.4793	17.1923	16.05±0.02	15.93±0.02	15.77±0.03	6.02

The galactic extinction is corrected with Schlafly & Finkbeiner (2011). Stellar masses are converted from the $r-$band magnitude using the mass to light ratio from Bell et al. (2003), i.e Log(M/L) = −0.306+1.097($g - r$)

TABLE 3
HI gas content

HI heliocentric velocity	3324 km/s
HI Flux	1.26 Jy-km/s ±10%
HI mass	8.7 ×10^8
Mean velocity width	79.89 ±1.2 km/s
M_{HI}/L_B	0.65

Atomic hydrogen (HI) 21-cm radio data are available in the Hyperlyda archive (Paturel et al. 2003). Observations of UGC 6741 were made with the Arecibo single dish telescope. The large beam size, ∼3' (Lu et al. 1993) , covered the entire interacting system. The cataloged archival HI parameters are listed in Table 3. We computed a total HI mass of 8.7×10^8 $M_\odot$, and an inferred HI mass to blue luminosity ratio, M_{HI}/L_B, of 0.65 $M_\odot/L_\odot$ [4]. This number is similar to the average value of M_{HI}/L_B for the sample of BCDs studied in Huchtmeier et al. (2005) but significantly lower than in typical isolated low-surface brightness dwarf galaxies (Pustilnik & Tepliakova 2011). We estimated the expected HI mass of UGC 6741 using an empirical relation between the HI mass and the diameter (Gavazzi et al. 2005), $M_{HIref} = a+blog(d)$. For this, we used the isophotal diameter provided by NED and adopted the constants a = 7.00 and b = 1.88 for Scd-Im-BCD type galaxies. The expected HI mass is less than half of the observed HI mass in the whole system.

The HI spectrum shows a single velocity peak (see Fig. 1 in Lu et al. 1993) that may suggest the absence of a kinematically distinct HI component for each galaxy. Note, however, that the observed velocity width is similar to the difference in radial velocity measured from the optical spectra of each galaxy, i.e. 76 km^{-1}.

[4] The B-band luminosity was derived from the $g-$band luminosity using the empirical formula of Lupton et al. (2004), i.e B = g+0.313($g - r$) + 0.227

2.4. *Optical spectroscopy*

The optical spectra of both UGC 6741 and UGC 6741_B were queried from the SDSS archives (see Fig. 6). They exhibit the emission lines typical of HII regions as well as relatively strong absorption for the early Balmer lines Hδ , γ and β. The emission line fluxes were measured after subtracting the stellar absorption features using the publicly available code GANDLF (Sarzi et al. 2006) and the stellar templates of Tremonti et al. (2004).

The extinction coefficient, E(B-V), derived from the Balmer decrement Hα/Hβ is nearly equal to zero for UGC 6741 and even below the standard value of 2.86 for UGC 6741_B. This may indicate a poor subtraction of the absorption at Hβ due to the low signal to noise ratio.

The Hα equivalent widths – 7.1 Å and 8.7 Å for UGC 6741 and UGC 6741_B respectively – are relatively small compared to the typical BCD's Hα equivalent widths (Gil de Paz et al. 2003).

Oxygen abundances, 12+log(O/H), were estimated with the two methods described, among others, by Marino et al. (2013), i.e the so–called N2 and O3N2 methods. The N2 method only considers the line ratio between Hα and [NII] while the O3N2 method uses a combination of the line ratios Hα/[NII] and [OIII]/Hβ. We obtained 12+log(O/H) = 8.3(8.3) and 8.3(8.2) dex from the N2(O3N2) method for UGC 6741 and UGC 6741_B, respectively. These values are in the range of typical BCDs (Gil de Paz et al. 2003; Vaduvescu et al. 2007). The systematic error of the methods is 0.2 dex.

3. DISCUSSION AND CONCLUSION

We have presented a case of a dwarf-dwarf merger in a group environment. Remarkably our multi-wavelength study, based on imaging and spectroscopy, could be carried out with data solely acquired from publicly available archives.

We discuss below the origin of its prominent star–forming tidal bridge and speculate on the future evolution of UGC 6741.

3.1. *Nature of the tidal features and its star-forming regions*

UGC 6741 is noteworthy for the presence of a tidal bridge hosting knots of star-formation, and in that respect resembles systems involving massive colliding galaxies, such as Arp 104 (Gallagher & Parker 2010) or Arp 188 (UGC 10214), also known as the Tadpole galaxy. A comparison between these systems is made in Figure 7.

Like UGC 6741, Arp 104 exhibits a prominent tidal bridge, with hints that part of the tidal material wraps around one of the interacting galaxies (NGC 5218, to the North). For this system however, there is no evidence for the presence of star–forming regions along the bridge.

Like in UGC 6741, the long single tail that emanates from Arp 188 hosts multiple compact knots of star formation. Some of its young massive star cluster are as massive as $\sim 10^6$ $M_\odot$ (Tran et al. 2003; de Grijs et al. 2003; Jarrett et al. 2006) and were most likely formed in situ in the tail out of gaseous material expelled from UGC 10214 during a dynamical interaction with a hidden or already destroyed companion.

Given its shape, the stellar filament of the system studied here is undoubtedly of tidal origin. Is it however as for Arp 104 a bridge connecting two interacting galaxies, namely UGC 6741 and UGC 6741_B, or a single tail like in Arp 188, with UGC 6741_B being a Tidal Dwarf Galaxy instead of a pre-existing object?

Interestingly, the gas phase metallicity derived from the SDSS archival spectra reveals within the errors no difference in Oxygen abundance between UGC 6741 and UGC 6741_B although the latter is three times less massive. The mass-metallicity relation would predict an abundance of about 0.2 dex lower.

Similar metallicities between the parent galaxy and its tidal dwarf are instead expected as the latter is made from material pre-enriched in the former (Duc et al. 2007, 2014). This may in principle argue in favor of the TDG hypothesis for UGC 6741_B. This is however without taking into account the rather large intrinsic scatter of the M-Z relation of 0.2 dex and of the systematic uncertainty in the abundance determination of the same order.

Besides, the existence of a prominent stellar continuum (see Fig. 6) suggests that the object has a significant fraction of old stellar populations and the presence of strong Balmer absorption lines is a signature of star-formation over an extended period of time. The TDGs so far discovered are rather characterized by the overall dominance of young stars and of an on-going instantaneous starburst. This suggests that UGC 6741_B is a pre-existing dwarf, which is interacting with UGC 6741. Therefore, the system would in fact be rather a scale down version of Arp 104, with an overall luminosity $\sim$4 mag fainter.

Evidence of in situ star-formation occurring in gas rich collisional debris has been reported in numerous massive interacting galaxies, including the Tadpole galaxy discussed above. Such regions are believed to be also a nursery of super star clusters (e.g. de Grijs & Parmentier 2007; de Mello et al. 2008; Peterson et al. 2009; Fedotov et al. 2011). Idealized numerical simulations of mergers reproduce the formation of massive and compact super star-clusters in tidal tails (Bournaud et al. 2008; Renaud et al. 2015) and predict they might be the progenitors of globular clusters, provided they survive internal feedback and external tidal shear. The most massive and extended of them may become independent tidal dwarf galaxies.

The same phenomena seems to also apply to dwarf-dwarf major mergers. The bridge of UGC 6741 hosts at at least four distinct knots of star-formation. They are as massive as $\sim 10^7$ M$\odot$; with stellar mass density reaching $\sim 10^8$ $M_\odot$ kpc^{-1} [5], they could evolve into globular clusters or even ultra compact dwarf galaxies. Their parent galaxies being low-mass systems with shallow potential well, one may speculate that they will survive longer than in the environment of systems involving massive merging galaxies.

3.2. *Dwarf-Dwarf merger*

De Lucia et al. (2006) show that the statistical probability of merger of galaxies decreases towards the low mass regime. Our study of UGC 6741, however, proves that dwarf-dwarf tidal interactions and mergers occur in

[5] Assuming sizes equal to the observed FWHM

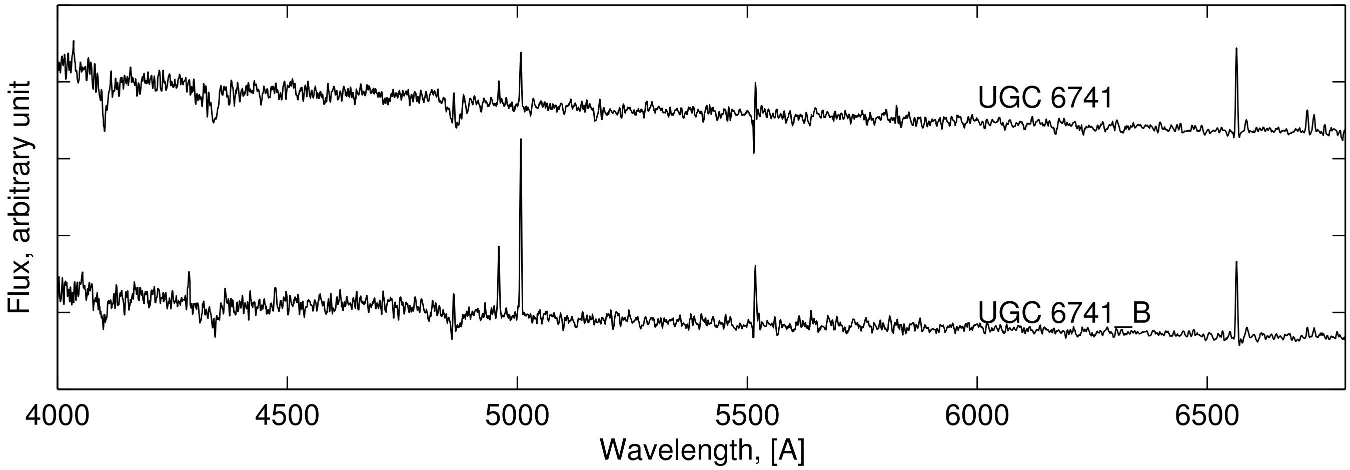

FIG. 6.— SDSS optical spectra of UGC 6741 and its companion UGC 6741_B. The observed spectra are shifted to rest frame wavelength and smoothed with a 3 pixel gaussian kernel.

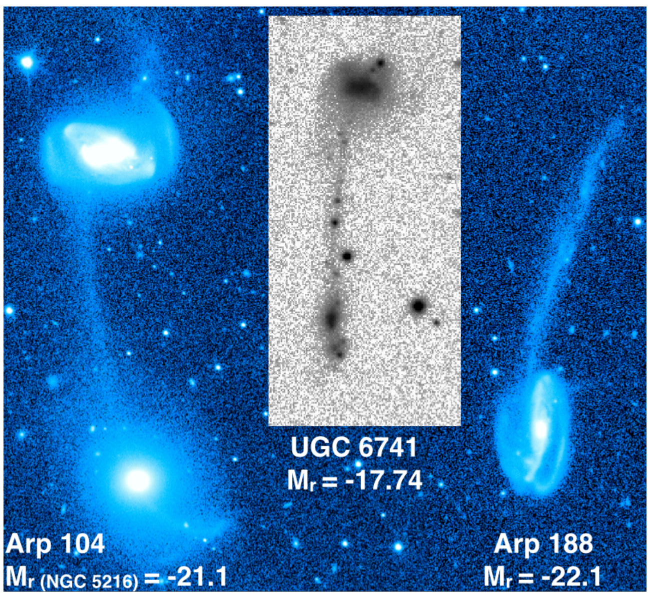

FIG. 7.— Direct comparison between Arp 104 and Arp 188 (in blue scale) with UGC 6741 (in grey-inverted scale). The optical $r-$band images for Arp 104 and Arp 188 were also obtained from the SDSS.

the nearby Universe. How frequent are they? On the one hand, exploring the Millennium cosmological Simulation, Moreno et al. (2013) found that binary mergers in isolation are very rare, and claimed that satellite-satellite mergers should play a higher role than so far anticipated. On the other hand, Klimentowski et al. (2010) used the Constrained Local Universe Simulation (CLUES) to conclude that interactions between satellites are unlikely. In a group environment, mergers between sub-haloes are predicted to occur only before they entered the host halo. Interestingly, UGC 6741 is itself located in the very outskirts of a group.

In the real Universe, reported cases of possible dwarf-dwarf mergers have increased recently (e.g. Amorisco et al. 2014; Martínez-Delgado et al. 2012; Penny et al. 2012; Rich et al. 2012). Distorted HI morphologies and the presence of gaseous tails around starbursting dwarf galaxies have also been attributed to mergers (e.g Johnson 2013; Nidever et al. 2013). However, direct evidence for an on-going tidal interaction between objects of roughly similar masses remains rare. Rich et al. (2012) found that the nearby Magellanic irregular galaxy NGC 4449 makes a pair with a tidally disrupted dwarf galaxy. This interaction will lead to a 1:50 merger, whereas UGC 6741 corresponds to a 1:3 merger. In the world of massive galaxies, this would be considered as a major merger.

3.3. *Evolution of dwarf galaxies*

Several physical properties of UGC 6741, i.e. color, metal content and star-formation rate, are fairly similar to typical blue compact dwarf galaxies and there is little doubt that its star formation activity is affected, if not triggered, by the interaction. Once the burst is terminated and the galaxies have merged, which type of dwarfs will UGC 6741 resemble? Its position on the scaling relations between structural parameters can give clues on its future evolution.

In Figure 8, we compare its properties with that of samples of non-interacting dwarfs. As a comparison sample, we used the Virgo Cluster BCDs and dEs from Meyer et al. (2014) and Janz & Lisker (2008) respectively.

BCDs occupy a position distinct from dEs in both M_r - $<\mu>$ and M_r - Re scaling relations. In particular, they have a higher surface brightness than dEs of similar magnitude. UGC 6741 which has a total luminosity similar to the brightest BCDs in the comparison sample lies within the locus of dEs. Meyer et al. (2014) proposed a formation channel of some dEs through a BCD phase, an evolution scheme that UGC 6741 may also follow. Yet, given its current star formation rate of 0.18 $M_\odot$ yr^{-1} and the mass of its gas reservoir estimated from the HI data, its gas depletion time is high (>3 Gyr). Thus additional processes other than star-formation are needed to remove the gas reservoir and make UGC 6741 a gas-poor red and dead galaxy.

Therefore, UGC 6741 appears as a scale down version of gas–rich massive interacting systems: like the latter, it hosts a prominent long tidal filament hosting young super star clusters that will possibly evolve into globular clusters or ultra compact dwarf galaxies. A further comparison study would require high resolution optical imag-

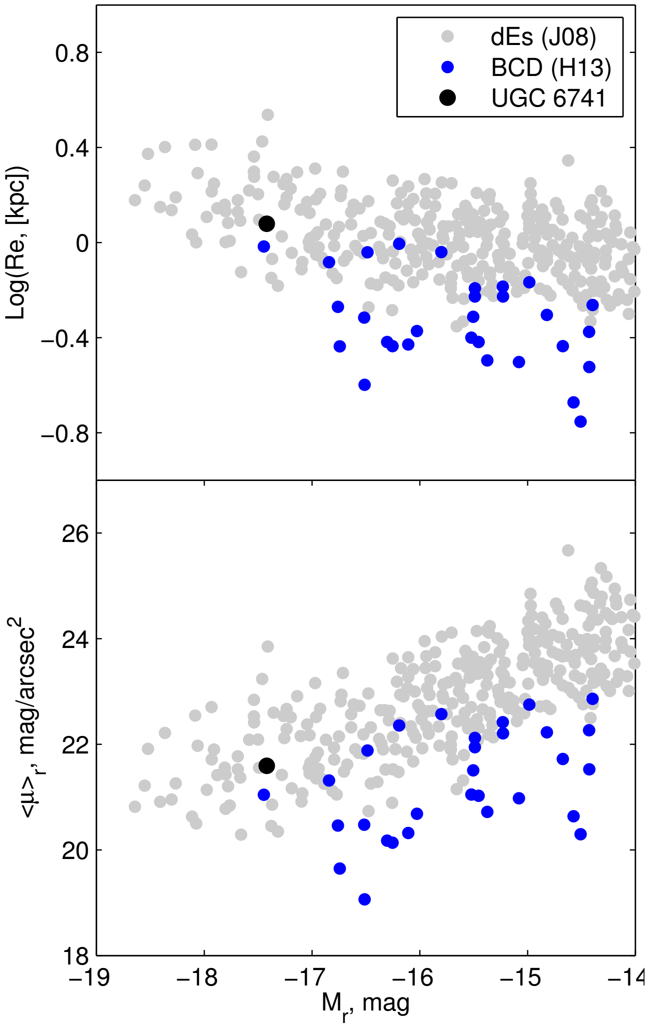

FIG. 8.— Scaling relations for dwarf galaxies. The two well established relations, effective radius vs luminosity, Log(R_e) vs M_r (top panel) and surface brightness vs luminosity, $< \mu >_r$ vs M_r (bottom panel) are shown for a sample dEs (gray dots, from Janz & Lisker (2008)) and BCDs (blue dots, from Meyer et al. (2014)). UGC 6741 is shown with the black solid circle.

ing and spectroscopy and to acquire HI/CO gas maps, in additional to the wealth of multi-wavelength data already available in the archives. Such observations would give clues on the future evolution of the system. Whether gas–rich dwarf-dwarf mergers form dwarf elliptical galaxies the same way as spiral-spiral mergers form massive ellipticals is still an open question. Cosmological simulations have so far given somehow contradicting results on the merger probability in the dwarf population. A statistical census of tidally interacting dwarfs should now be carried out. This was a motivation for us to systematically inspect large scale imaging surveys such as the SDSS or the NGVS in the Virgo Cluster. Results of this statistical analysis will be presented in future papers (Paudel et al in preparation).

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